

## **FY05-LIII(53)-139**

### **Investigation of Mercury and Carbon-Based Sorbent Reaction Mechanism – Comparison of Surface Analysis Techniques**

Submitted by: Energy & Environmental Research Center

Principal Investigator: Charlene Crocker

#### **PARTICIPANTS**

##### **Sponsor**

##### **Cost Share**

SaskPower	\$ 19,500
DOE	\$ 21,000
NDIC	<u>\$ 19,500</u>
Total Cost	\$ 60,000

#### **Project Schedule - 7 Months**

Contract Date – 6/10/05  
Start Date – 6/15/05  
Completion Date – 1/1/06  
Time Extension – ~~3/31/06~~  
Revised to – 1/31/07

#### **Project Deliverables**

Contract Signed:  
Quarterly Reports:  
10/31/05(✓); 1/31/06(✓)  
Final Report 1/31/07( );

#### **OBJECTIVE / STATEMENT OF WORK:**

This project is an extension of LRC-LI (51)-131, Investigation of Mercury and Carbon-Based Sorbent Reaction Mechanisms. Additional fundamental work will focus on bonding on carbon surfaces using two more refined techniques of x-ray photoelectron spectroscopy and x-ray absorption fine structure spectroscopy. The results will define carbon sorbent surface structural features before and after exposure to various treatment methods (chlorine gas levels) flue gas stream, providing direction to improving mercury capture effectiveness.

#### **STATUS**

##### **July 1 – September 30, 2005 Quarterly Report**

On-going studies indicate that a key surface component that impacts mercury oxidation and retention by activated char result from chemisorption of chloride and sulfur species from flue gas. The char appears to form organically associated chloride on key sites for bonding with oxidized mercury. The key sites thought to impact mercury capture include acidic carboxyl, lactone, hydroxyl, carbonyl functionalities or alkaline pyrone and chromene functionalities. A matrix of activated carbon was pretreated with 3%-5% chlorine to characterize char surface alterations. Analytical characterization methods will employ XPS and XAFS analysis.

##### **October 1 – December 31, 2005 Quarterly Report**

Activities during this quarter focused on the analysis of the XAFS data. A preliminary analysis prepared by the University of Kentucky described a surface chemistry consistent with the results of the XPS analysis. These data need further reduction to determine halogen speciation on the carbon surface. The preliminary interpretation of research results as provided by the University of Kentucky conflicts somewhat with the interpretation of research results obtained previously by the

EERC. EERC intends to review the analysis and discuss the interpretation prior to reporting them. Data reduction is ongoing and will be presented in the next report.